PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
08400-027		

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CA2004/000959	25.06.2004	27.06.2003

International Patent Classification (IPC) or national classification and IPC
B29C70/44, B29C70/54

Applicant
LA CORPORATION DE L'ECOLE POLYTECHNIQUE DE ...

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 16 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26.04.2005	13.10.2005

Name and mailing address of the international preliminary examining authority:

European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized Officer

Van Wallene, A

Telephone No. +31 70 340-3611

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/CA2004/000959

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-41	as originally filed
6a	received on 28.04.2005 with letter of 26.04.2005
Claims, Numbers	
1-72	received on 28.04.2005 with letter of 26.04.2005
Drawings, Sheets	
1/34-34/34	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/CA2004/000959

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	4,5,7,8,10-14,18-20,23-27,29-46,48-72
	No:	Claims	1-3,6,9,15-17,21,22,28,47
Inventive step (IS)	Yes:	Claims	4,5,7,8,10-14,18-20,23-27,29-46,48-72
	No:	Claims	1-3,6,9,15-17,21,22,28,47
Industrial applicability (IA)	Yes:	Claims	1-72
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

The following documents are referred to in this communication:

D1 : DE 199 26 896 A (VER FOERDERUNG INST KUNSTSTOFF) 14 December 2000 (2000-12-14)
D2 : FR 2 828 130 A (POLE DE PLASTURGIE DE L EST) 7 February 2003 (2003-02-07)

Note:

1. Certain features have been added to claim one with the amendments filed on 28th of August 2005, which are considered unclear because they define a result to be achieved without defining structural features allowing to propagate the matrix along a propagation direction.
It is furthermore noted that the device shown in figure 2 of document D2 is *suitable* to perform the same function provided the flowfront has passed fluid inlet (8).
Furthermore the expression 'controlling fluid' is not clear as no definition is given which process or property is supposed to be controlled. For this reason this expression is interpreted in its broadest sense, that is to say, controlling of the impregnation of the strengthener.

Novelty

2. Taken the above into account, the subject matter of **claim 1** is not new over document D2:

A mold assembly for generating a composite part from a strengthener in a generally solid phase and a matrix in a generally liquid phase; said mold assembly comprising:
a) a base mold (1) including a strengthener chamber (5) for receiving the strengthener (4), a matrix injection inlet (9) for injecting the matrix in said strengthener chamber and an evacuation outlet (11), said inlet and said outlet defining a propagation direction (13);
b) a cover mold (2) including a compression chamber (3) and a fluid control aperture (8) for injecting a controlling fluid in said compression chamber; said cover mold

being so configured as to be sealingly mounted (6) on said base mold whereby said strengthener chamber and said compression chamber are adjacent (fig. 2); and c) a deformable member (14) provided in a gap defined by said strengthener chamber and said compression chamber, said deformable member being so configured as to pressurize the matrix toward the strengthener and *suitable for* propagating the matrix along said propagation direction upon compression exerted on said deformable member by the controlling fluid.

3. The *structural* features of *apparatus* claims **2, 3, 6, 9,15-17, 21, 22, 28** are also known from D2 and are therefore not novel either.

4. The subject matter of **claims 36 and 42** is new, since none of the prior art documents show a frame assembly with separators in combination with the further features of claim 36 and 42 respectively.

5. Dependent claims **37 to 41** and **43 to 46** are therefore also novel.

6. The features of claim **47** are disclosed in D2. Reference is made to the discussion for claim 1 above which is of similar scope.

7. Claim **48**
Claim 48 has been amended by introducing the feature of "propagating the matrix...by pressurizing a controlling fluid injected in said second chamber". This feature is not known from the prior art. The subject matter of claim **48** and its dependent claims **49 to 64** is therefore novel.

8. Claims **65 and 68** as well as their dependent claims **66, 67 and 69 to 72** define a resin injection process using an alternating stack of strengtheners and deformable members. These features are not known in combination from the prior art, for which reasons these claim are novel.

Inventive step

9. The subject matter of claims **1, 2, 3, 6, 9, 15-17, 21, 22, 28** and **47** is not novel, and

therefore does not involve an inventive step either.

10. The features of the dependent claims **4, 5, 7, 8, 10 to 14, 18 to 20, 23 to 27 and 29 to 35** are not known in combination with the features of the claim(s) they refer to from the prior art. Each of these claims however solve a different problem. Although these claims might involve an inventive step, this report is limited to the first dependent claim (claim 4). The use of an incompressible fluid is neither known from nor rendered obvious from the prior art. It solves the problem of insufficient resin flow controllability due to the compressibility of gaseous media.

11. Although the technology of stacking alternating layers of composite material and release films is known per se, a combination with the features as defined in claim 1, in particular the use of compression chamber or chambers is not known. It solves the problem of not being able to produce multiple composite parts simultaneously using the advantages of resin transfer moulding using a deformable member. Therefore the claims **36 to 46 and 65 to 72** relating to the use of stacking subsequent strengthening layers and deformable members is considered to be novel and involving an inventive step.

Industrial Applicability

12. The claimed subject matter is considered to be industrially applicable and thus fulfilling the requirements of article 33(4) PCT.

Further remarks

13. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

14. Although claims 1, 36, 42, 47 and 48, 65, 68 respectively have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack

conciseness and as such do not meet the requirements of Article 6 PCT.

[0026.1] As another example, Wassenberg in DE199,26,896 teaches about a mol impregnation apparatus including a two-part mold configured and sized as to be sealingly mounted to one another with a flexible membrane in between. One of the molds receives the strengthener and the other one is provided with a series of channel for receiving the membrane when vacuum is provided in the apparatus, generating thereby less restriction during impregnation of the strengthener. In this apparatus however, no controlling fluid is provided for controlling the impregnation of the matrix by the strengthener.

[0026.2] As a further example, Cauchois et, al. in FR2,828,130 teach about a mold impregnation apparatus and method. The apparatus includes a two-part mold configured and sized as to be sealingly mounted to one another with a membrane in between. One of the molds receives the strengthener and the other one is provided with an access to a chamber defined between the latter mold and the membrane, providing thereby means for compressing, with air in an autoclave, the membrane and consequently, the strengthener on the other side of the membrane. In this apparatus however, the compaction by air is provided after the impregnation of the matrix by the strengthener for evacuating the excess of matrix already impregnated in the strengthener.

Claims

1. A mold assembly for generating a composite part from a strengthener in a generally solid phase and a matrix in a generally liquid phase; said mold assembly comprising:

   a) a base mold including a strengthener chamber for receiving the strengthener, a matrix injection inlet for injecting the matrix in said strengthener chamber and an evacuation outlet, said inlet and said outlet defining a propagation direction;

   b) a cover mold including a compression chamber and a fluid control aperture for injecting a controlling fluid in said compression chamber; said cover mold being so configured as to be sealingly mounted on said base mold whereby said strengthener chamber and said compression chamber are adjacent; and

   c) a deformable member provided in a gap defined by said strengthener chamber and said compression chamber, said deformable member being so configured as to pressurize the matrix toward the strengthener and propagate the matrix along said propagation direction upon compression exerted on said deformable member by the controlling fluid.

2. A mold assembly as recited in claim 1, wherein said deformable member is able to be swollen in said compression chamber from the matrix permeating the strengthener to generate a deformation zone, said deformable member receiving pressure from the controlling fluid in proximity of said deformation zone for redirecting the matrix towards the strengthener.

3. A mold assembly as recited in claim 2, wherein said deformation zone is adjacent to a matrix flow front corresponding to a portion of the strengthener impregnated by the matrix, said matrix flow front propagating in the strengthener along said propagation direction as the matrix in said deformation zone is redirected to the strengthener.

4. A mold assembly as recited in claim 1, wherein said controlling fluid is an incompressible fluid.

5. A mold assembly as recited in claim 1, wherein said matrix injection inlet includes a diffusion passage provided on a contact wall of said strengthener chamber.

6. A mold assembly as recited in claim 1, wherein said evacuation outlet is connectable to a vacuum source to selectively generate at least a partial vacuum in said strengthener chamber.

7. A mold assembly as recited in claim 1, wherein base mold includes a contact wall, peripheral walls extending around said contact wall and shoulders extending around said peripheral walls; said cover mold includes a compression wall, peripheral walls extending around said compression wall and shoulders extending around said peripheral walls, said cover mold being sealingly mounted to said base mold through a complementary ridge and groove arrangement provided along said shoulders of said base mold and said cover mold.

8. A mold assembly as recited in claim7, wherein said ridge and groove

arrangement has a generally triangular cross-sectional profile.

9. A mold assembly as recited in claim 1, wherein said fluid control aperture is connectable to a fluid source to generate pressure in said compression chamber.

10. A mold assembly as recited in claim 1, wherein said fluid control aperture extends in said cover mold and said matrix injection inlet extends in said base mold in a generally similar direction.

11. A mold assembly as recited in claim 1, wherein said cover mold includes a vent extending from said compression chamber and through said cover mold.

12. A mold assembly as recited in claim 11, wherein said vent is connected to a vacuum source to selectively generate at least a partial vacuum in said compression chamber.

13. A mold assembly as recited in claim 11, wherein said vent comprises a valve to regulate the flow of the controlling fluid through said vent.

14. A mold assembly as recited in claim 1, wherein said gap has a variable thickness.

15. A mold assembly as recited in claim 14, wherein said compression chamber has a first thickness, said strengthener chamber has a second

thickness, said first and second thickness being variable upon deformation of said deformable member.

16. A mold assembly as recited in claim 1, wherein said deformable member includes a membrane sealingly mounted between said strengthener chamber and said compression chamber.

17. A mold assembly as recited in claim 16, wherein said membrane is impermeable to liquid.

18. A mold assembly as recited in claim 16, wherein said membrane is permeable to gas.

19. A mold assembly as recited in claim 1, wherein said mold assembly includes a means for inducing vibrations to the controlling fluid injected in said mold assembly to expel residual gases entrapped in the strengthener.

20. A mold assembly as recited in claim 1, wherein said mold assembly includes temperature controlling means.

21. A mold assembly as recited in claim 1, wherein said strengthener chamber comprises a contact wall for locating the strengthener, said contact wall having a controlled surface finish.

22. A mold assembly as recited in claim 1, wherein said base mold and said cover mold are rigid.

23. A mold assembly as recited in claim 1, wherein said deformable member includes a deformable element and a membrane, said membrane being sealingly mounted between said strengthener chamber and said compression chamber, said deformable element being provided in at least a portion of said compression chamber.

24. A mold assembly as recited in claim 23, wherein a surface of said deformable element is so machined as to be complementary to the shape of the composite part.

25. A mold assembly as recited in claim 24, wherein said machined surface of said member includes a series of grooved channels so configured as to receive said membrane.

26. A mold assembly as recited in claim 23, wherein said deformable element is injected directly into said gap via said fluid control aperture.

27. A mold assembly as recited in claim 23, wherein said deformable element includes a generally porous and elastic material.

28. A mold assembly as recited in claim 1, wherein said deformable member includes an elastic material being provided in at least a portion of said compression chamber and adjacent to said strengthener chamber.

29. A mold assembly as recited in claim 1, wherein said cover mold includes

compartmentalized portions so configured as to independently move with respect to one another toward and away from said strengthener chamber for providing a gap of variable thickness.

30. A mold assembly as recited in claim 1, wherein said mold assembly further includes a tube provided in said compression chamber and adjacent to said strengthener chamber, said tube being connected to a pressure source and deformable under pressure generated from the pressure source, said tube including at least one extremity mounted through said cover mold for controlling the pressure in said tube.

31. A mold assembly as recited in claim 1, wherein said cover mold includes a compression wall including a plurality of passages provided adjacent to said deformable member.

32. A mold assembly as recited in claim 31, wherein said plurality of passages includes longitudinal passages and transversal passages configured in a grid so as to cooperate with said deformable member.

33. A mold assembly as recited in claim 31, wherein said matrix injection inlet of said base mold includes a diffusion passage extending on a contact wall of said strengthener chamber; said diffusion passage being generally aligned with at least one transversal passage and said matrix injection inlet of said base mold being generally aligned with at least one longitudinal passage.

34. A mold assembly as recited in claim 1, wherein said mold assembly

includes a porous medium provided in said compression chamber for controlling the propagation of the fluid injected in said compression chamber.

35. A mold assembly as recited in claim 34, wherein said porous medium is made from a generally deformable element.

36. A mold assembly for generating a predetermined number of composite parts from strengtheners in a generally solid phase and from matrix in a generally liquid phase; said mold assembly comprising:

a) a base mold including a strengthener chamber;

b) a cover mold including a compression chamber;

c) at least one frame assembly, each including a separator defining a further respective strengthener chamber and a further respective compression chamber; said at least one frame assembly being so configured as to be sealingly stacked one next to the other and between said base mold and said cover mold, whereby each of said strengthener chamber faces one of said compression chamber to define adjacent pairs of chambers;

d) matrix injection inlets for injecting the matrix in said strengthener chambers;

e) fluid control apertures for injecting a fluid in said compression chambers; and

f) deformable members so provided between said adjacent pairs of chambers as to pressurize the matrix toward the strengthener upon compression by the fluid.

37. A mold assembly as recited in claim 36, wherein each of said deformable members is a membrane sealingly mounted between said adjacent pairs of strengthener chamber and compression chamber.

38. A mold assembly as recited in claim 36, wherein said mold assembly further includes evacuation outlets and vents, said evacuation outlets extending from said strengthener chambers and through said mold assembly; said vents extending from said compression chambers and through said mold assembly.

39. A mold assembly as recited in claim 36, wherein said cover mold is one of said at least one frame assembly.

40. A mold assembly as recited in claim 36, wherein said cover mold is one of said at least one frame assembly including a cover reinforcement so configured as to be rigidly mounted in its respective strengthener chamber.

41. A mold assembly as recited in claim 36, wherein said separator is rigid.

42. A mold assembly for generating a predetermined number of composite parts from strengtheners and matrix; said mold assembly comprising:

a) a base mold including a contact wall;

b) at least one frame assembly so configured as to be sealingly stacked one next to the other on said base mold defining a stacking chamber thereby;

c) matrix injection inlets for injecting the matrix in the strengtheners

trough said base mold and said at least one frame assembly;

d) deformable elements, each having a respective compression wall and a further respective contact wall, said deformable elements being so configured as to be alternatively stacked with the strengtheners in said stacking chamber whereby each of said contact wall faces one of said compression wall; and

e) a cover mold including a further respective compression wall and being mounted in said stacking chamber.

43. A mold assembly as recited in claim 42, wherein each of said deformable elements is porous elastic material.

44. A mold assembly as recited in claim 43, wherein each of said at least one frame assembly includes a fluid control aperture for injecting a fluid in said stacking chamber to said deformable elements.

45. A mold assembly as recited in claim 42, wherein each of said at least one frame assembly and said base mold are sealingly stacked in adjacent pairs and said mold assembly further includes membranes sealingly mounted between said adjacent pairs.

46. A mold assembly as recited in claim 45, wherein each of said at least one frame assembly includes a fluid control aperture extending for injecting a fluid between each of said deformable elements and each of said membranes in said stacking chamber.

47. A mold assembly for generating a composite part from a strengthener and

a matrix; said mold assembly comprising:

a) a base mold including a strengthener chamber for receiving the strengthener; a matrix injection inlet for injecting the matrix in said strengthener chamber and an evacuation outlet, said inlet and said outlet defining a propagation direction;

b) a cover mold including a compression chamber and a fluid control aperture for injecting a controlling fluid in said compression chamber; said cover mold being so configured as to be sealingly mounted on said base mold whereby said strengthener chamber and said compression chamber are adjacent; and

c) a deformable member provided in a gap defined by said strengthener chamber and said compression chamber said deformable member generating a deformation zone in said compression chamber from a portion of the matrix permeating the strengthener, said deformable member being pressurized by the controlling fluid in proximity of said deformation zone for redirecting the portion of matrix generating said deformation zone back to the strengthener and for propagating the matrix along said propagation direction.

48. A method for generating a composite part from a strengthener and a matrix comprising:

a) sealingly positioning a deformable member in between a first chamber of a first mold portion and a second chamber of a second mold portion; said first chamber receiving the strengthener;

b) impregnating the strengthener with the matrix injected in said first chamber;

c) propagating the matrix in and along the strengthener by pressurizing a

controlling fluid injected in said second chamber on said deformable member.

49. A method as recited in claim 48, wherein said impregnating the strengthener is performed at a vacuum pressure which is lower than atmospheric pressure.

50. A method as recited in claim 48, wherein said propagating the matrix in and along the strengthener is performed while heating said controlling fluid.

51. A method as recited in claim 48, wherein said propagating the matrix in and along the strengthener is performed at a compaction pressure greater than atmospheric pressure.

52. A method as recited in claim 48, wherein said propagating the matrix in and along the strengthener by pressurizing a controlling fluid injected in said second chamber on said deformable member is delayed after said injecting the impregnating the strengthener with the matrix injected in said first chamber is performed.

53. A method as recited in claim 48, further including vibrating the impregnated strengthener to expel a significant portion of residual gases entrapped in the strengthener.

54. A method as recited in claim 48, further including a solidification of the composite part at a compaction pressure greater than atmospheric pressure.

55. A method as recited in claim 48, further including a cure of the strengthener with heat transfer applied to said mold and the solidification of the composite part at a compaction pressure greater than atmospheric pressure.

56. A method as recited in claim 55, wherein said cure of the strengthener uses ultra-violet light.

57. A method as recited in claim 54, wherein said solidification of the composite part is performed while decreasing the temperature of the strengthener.

58. A method as recited in claim 48, further including a positioning of a deformable element in a second chamber of a second mold portion adjacent to said deformable member.

59. A method as recited in claim 48, further including a positioning of a tube in a second chamber of a second mold portion adjacent to said deformable member.

60. A method as recited in claim 59, wherein said propagating the matrix in and along the strengthener by pressurizing a controlling fluid is performed while pressurizing said tube whereby said tube deforms and compresses said member by compressing said controlling fluid.

61. A method as recited in claim 59, wherein said propagating the matrix in and along the strengthener by pressurizing a controlling fluid is performed while

pressurizing said tube whereby said tube deforms and compresses said member.

62. A method as recited in claim 48, wherein said propagating the matrix in and along the strengthener by pressurizing a controlling fluid is performed while varying the position of compartmentalized portions of said second mold portion with respect to said member.

63. A method as recited in claim 48, further including a deformation of said member mating with passages in said second mold portion provided adjacent to said member.

64. A method as recited in claim 48, further including a positioning of a porous medium in a second chamber of a second mold portion adjacent to said deformable member.

65. A method for generating a pre-determined number of composite parts from strengtheners and matrix comprising:

a) sealingly positioning a deformable member in between a strengthener chamber of a first mold portion and a compression chamber of a second mold portion; said strengthener chamber including the strengthener;

b) repeating said sealingly positioning a deformable member by stacking a number of subsequent mold portions one next to the other determined by a predetermined number of parts to manufacture;

c) impregnating the strengtheners with matrix injected in said strengthener chambers;

d) compacting the matrix toward the strengthener by pressurizing a controlling fluid injected in said compression chamber on said deformable member.

66. A method as recited in claim 65, wherein said impregnating the strengtheners with matrix injected in said strengthener chambers is performed with a delay between each sequential injection of matrix in consecutive strengtheners.

67. A method as recited in claim 65, further including a cure of the strengtheners performed by heating said first mold portion; whereby said second mold portions and said subsequent mold portions are sequentially heated by heat transfer from a previously heated mold portion.

68. A method for generating a predetermined number of composite parts from strengtheners and matrix comprising:

a) positioning an alternating stack of strengtheners and deformable members in a stacking chamber generated by sealingly mounting frame assemblies on a base mold assembly;

b) impregnating the strengtheners with matrix injected in said stacking chamber;

c) compacting the matrix toward and along the strengtheners by pressurizing on said stack of strengtheners and deformable members.

69. A method as recited in claim 68, wherein said impregnating the strengtheners with matrix is performed while successively injecting the

matrix into consecutive strengtheners with a slight delay between each injection.

70. A method as recited in claim 69, wherein said compacting the matrix is performed while said successively injecting the matrix, said successively injecting the matrix including at least a first injection in a first strengthener and a second injection in a second strengthener with a delay from said first injection; said second injection compressing said first strengthener by pressurizing said deformable member provided in between said first and second strengthener.

71. A method as recited in claim 68, wherein said positioning an alternating stack of strengtheners and deformable members further provides for a membrane provided in between the strengtheners and the deformable members.

72. A method as recited in claim 71, wherein said compacting the matrix toward and along the strengthener is performed while pressurizing a controlling fluid injected in said stacking chamber on said membrane.